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DIURNAL EFFECT IN COSMIC RAYS AT MIDDLE LATITUDES ACCORDING TO STRATOSPHERIC MEASUREMENTS

Asatryan G.A., Babayan V.Kh.
Yerevan Physics Institute, Markarian st.2
375036, Yerevan, Armenia, USSR

Stozhkov Yu.I.
P.N. Lebedev Physical Institute of the Academy of Sciences of the USSR, Leninsky prospect,53, 117924, Moscow, USSR

ABSTRACT

Results of measurements of the diurnal wave of the cosmic ray (CR) intensity in stratosphere at the latitude with the geomagnetic cutoff rigidity R_c = 7.6 GV are presented.

Measurements of diurnal variation of the CR intensity were carried by means of radiosondes - by a detector composed of a gas-discharge counter CTC-6 and a telescope containing two counters with a 7 mm aluminium filter between them. Radiosondes were launched in Yerevan daily during a month (May 23 to June 23, 1984) at the following hours: 2,5,8,11,14,17,20,23 LT. The period of time during which the measurements were carried out is characterized by a quiet situation: the average three-hourly value $K_p < 3$ [1]. The CR intensity fluctuations in the absorption curve maximum in stratoaphere did not exceed ~2.5%

at high altitudes (R_c = 0.5 GV) and $\sim$ 1% at the latitude with R_c = 2.5 GV.

Experimental data allowed to obtain the altitude dependence of the CR intensity on the atmospheric depth, N(x), for eight different times of LT. To reveal the diurnal wave of the CR intensity in stratosphere, we have used the following method of processing of altitude dependences for a vertical CR flux. Three pressure intervals X = 8 + 50, 50 + 100 and 100 + 150 g/cm^2 were analyzed, each of which was in its turn divided into several subintervals. Then the mean for the daily CR intensity for each interval, $\overline{N}(x)$, was found. After that the value $\delta = \frac{N_i(x) - \overline{N}(x)}{\overline{N}(x)}$, %, was defined, where i is the time of measurements. To improve the accuracy, values of δ were averaged for each interval. Mean values of $\overline{\delta}$ are presented in figs. 1a,b,c for the above three pressure intervals. A diurnal wave is observed with the amplitude which decreases from $\sim$ 4% to $\sim$ 2% with the increase in the atmosphere pressure from $\sim$ 30 g/cm^2 to $\sim$ 130 g/cm^2. The time of maximum is $11 \div 14^h$ LT. These results agree with measurements of the diurnal wave in stratosphere carried out in 1981 [2]. The daily wave of the CR intensity on the neutron monitor in Tbilisi (R_c = 7.4 GV) is presented in fig.1d for the same period of the time (23 May $\div$ 23 June 1984).

The dependence of the diurnal wave amplitude on the atmospheric depth X is shown in fig.2. A substantial decrease in the value of $\overline{\delta}$ is observed with the increase in

the atmospheric depth.

Certain difficulties arise in trying to give a correct explanation of a large amplitude of the CR intensity diurnal amplitude in stratosphere (~ 4%) and of the early time of maximum ($11^h \div 14^h$ LT). The presence of such a large anisotropy of CR in stratosphere may be connected to the anisotropic pitch-angular distribution of particles in the interplanetary space and possible to the large contribution of nuclei of galactic cosmic rays in the diurnal wave. It is difficult to explain the obtained results by the temperature effect in cosmic rays or by the drift radiosondes during the flight and appropriate variations of the value of R_c.

References:

1. Solar Geophysical Data.(1984), N° 479, part 1, p.91, N° 480, part 1, p.86, Boulder, USA.
2. G.A. Asatryan, Yu.I. Stozhkov, (1983), 18-th ICRC, Bangalore, India, v.3, p.299.

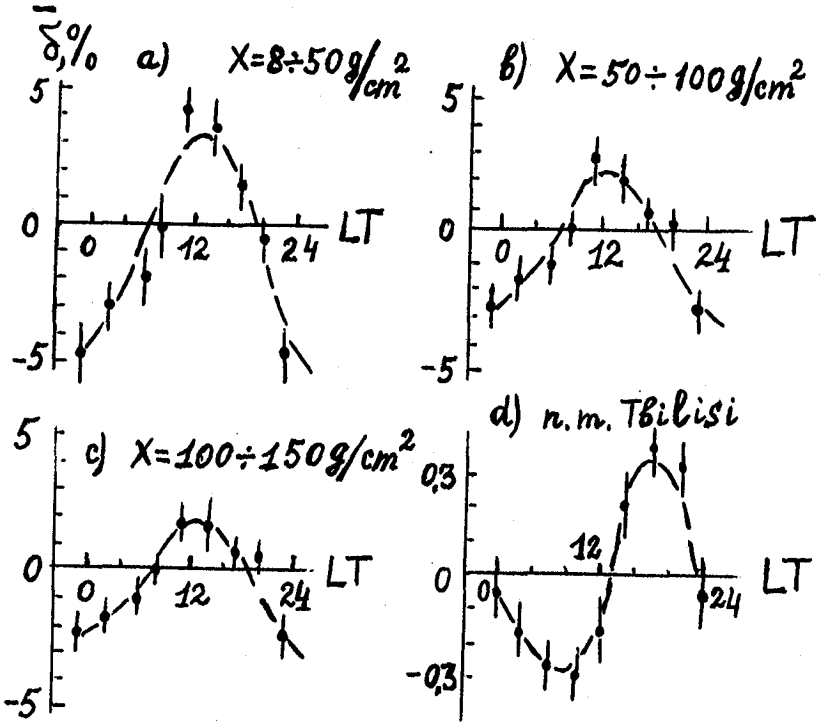

Fig.1. The diurnal wave of CR intensity according to the measurements in 23 May ÷ 23 June 1984 in the stratosphere (Yerevan, R_c=7,6 GV) at the atmospheric pressure X=8÷50 g/cm (a), X=50÷100 g/cm (b), X=100÷150 g/cm (c) and on the neutron monitor Tbilisi, R_k=7,4 GV (d).

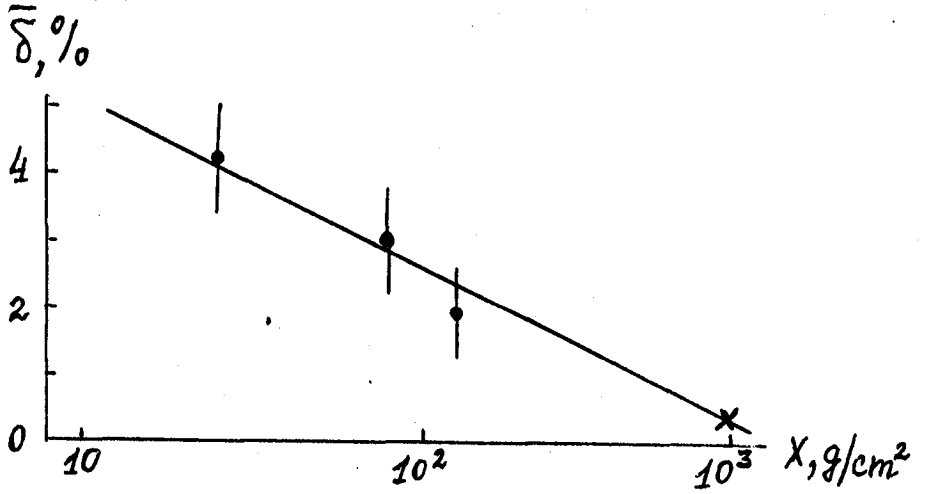

Fig.2. The diurnal wave amplitude at the different atmospheric data; X - neutron monitor Tbilisi, • - stratospheric data.